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THE ORIGIN OF THE DORIC ENTABLATURE[1]

[PLATE VII]

FIXITY OF DORIC FORMS.—Of all the architectural forms which have apparently no definite structural significance, there is none which has persisted with so little variation as the entablature of the Greek Doric order. Modern copies of course prove nothing, our taste being as eclectic as that of the Romans; but that the Greeks themselves used this form continuously for a period of over four hundred years without showing the slightest variation in the arrangement of regulae, taenia, triglyphs, metopes, mutules, and corona, or even in the number and disposition of the guttae, and with practically no change in the relative proportions of these parts, is a fact unparalleled in architectural history.[2]

Even the column of the Doric order shows much greater variation than this entablature, not only in its proportions, but in the number of its channels, the number of the annulae below the echinus, the occasional substitution of a decorated neck cove for these latter, and so forth.

This remarkable fixity in a form which frankly contradicts in many cases the stone construction it ornaments, must have been due either to the parallel existence of similar forms in another material,—where structural reasons prevented change,—from which the stone forms were continually and literally imitated; or to a tradition derived from some such anterior structural forms, that had endured long enough to become artistically, if not actually, sacred to the Greeks. It is, of course, altogether possible that throughout the historic period buildings were erected in Greece with structural Doric entablatures of wood, crude brick,

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[1] I beg to acknowledge the very helpful criticisms and suggestions which I have received from Professor Bates of the University of Pennsylvania, and from Dr. Caskey of the Boston Museum of Fine Arts.

[2] Such exceptions as the temples C and D at Selinunte, where the mutules are alternately large and small, are, as will be shown later, only a special form of the general arrangement.

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terra-cotta, or other material, and that these furnished the models for the temples in stone, but it is not customary to imitate a meaner material in a more magnificent one for a long period of time, unless the former has first become venerable by its antiquity. Moreover, the only direct evidence that we have for a Doric entablature in wood is the reference by Pausanias to that of the temple of Hera at Olympia,[1] which, according to a legend he mentions, was built eight years after Oxylos had captured Elis, and certainly must have appeared very old in his day.

The known fixity of form of the Doric entablature in stone from the seventh century B.C. for at least four centuries indicates, therefore, that a period at least equal in length, during which this form was developed structurally and made classic in some other material, must have elapsed before this date; for the rate of development of architectural and artistic forms is always much slower during the first phases of a civilization. If this be true, the origin of the Doric entablature cannot be much posterior to the Dorian invasion, and it seems altogether probable that if no traces of it are to be found in the last architecture of the previous inhabitants, the germs of it at least must have been brought down from the north by the invaders.

Nothing whatever is known of the architecture of these northerners prior to their descent into Greece, but there are quite copious documents for the late Minoan architecture both in Crete and on the mainland, representations in terra-cotta, metal, and frescoes, as well as considerable remains of the buildings themselves; so that by considering this alternative alone it should be possible to decide the probable source of origin.

MINOAN ARCHITECTURAL FORMS.—Fortunately the late Minoan artists were decided realists. Freedom from convention and obvious study from life are strikingly shown in their representations of men and animals. Even in vase paintings, where the natural tendency would be toward formal decoration, we find plant and shell forms of surprising faithfulness to nature.[2] There is, therefore, every reason to believe that the fresco representations of architecture give a true idea of the architectural forms of the Minoan period. This truthfulness of course does not apply to matters of scale, for until the modern discovery of correct linear perspective artists have never been at much pains to make the scale of their architecture agree with that of their figures.

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[1] Pausanias, V, 16, 1. The existence of a wooden column obviously argues the existence of a wooden entablature above it.

[2] Bulle. *Orchomenos*, p. 75, in *Abh. Münch. Akad., Philos.-Philol. Kl.*, XXIV.

Except for minor variations the architecture represented in Minoan art is of a single well marked type (Fig. 1).[1] It shows us a basement of squared stones; above this an open portico consisting of two side piers, or ends of walls, undoubtedly of unbaked brick reinforced by longitudinal and transverse beams of wood;[2] between these, one or more columns, with simple block bases, shafts larger at the top than at the bottom, and large, rather bulbous capitals; supported by these side walls and columns, a transverse

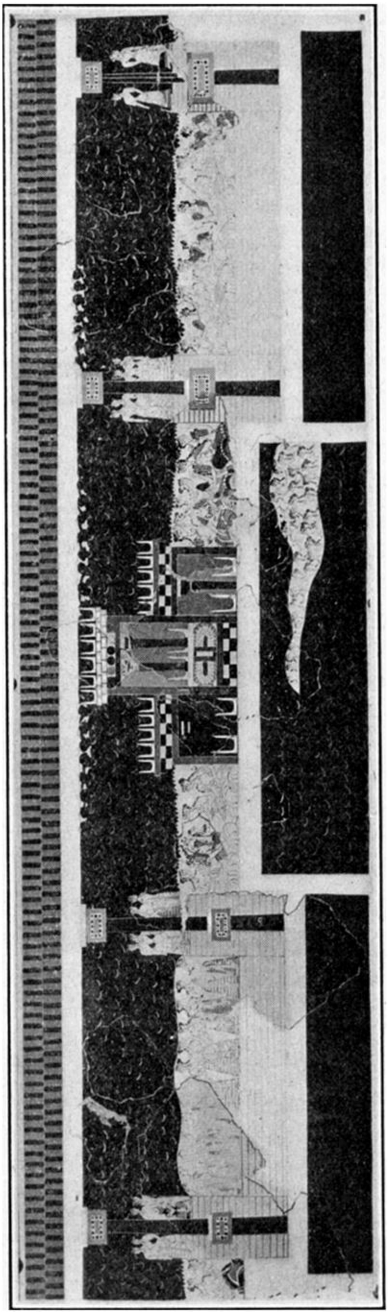

FIGURE 1.—FRESCO FROM CNOSSUS. (From a restoration by Gilliéron, in the Museum of the University of Pennsylvania)

lintel beam, which in turn supports a series of round beams laid close together at right angles to it, and on these again a thick horizontal roof, presumably of clay. The face of this thick roof is usually covered with large black and white checkers, probably indicating masonry (or plaster painted in imitation of masonry) which rests on a beam laid across the ends of the round roof-timbers. On either side of this portico there is usually a smaller portico, never with more than one column but otherwise exactly similar in arrangement to the central portico. It has been suggested by Noack (*Homerische Paläste*, p. 78) that these lateral porticoes represent side views of the central portico, but as such an hypothesis would not affect the architectural forms shown, it does not concern us here.

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[1] Fresco from Cnossus, Evans, *B.S.A.* X, 2; 'Mycenaean Tree and Pillar Cult,' *J.H.S.* XXI, 1901, pl. V. Gold plaques from Mycenae, Schliemann, *Mycenae*, fig. 423.

[2] The black marks with thickened ends which cross these walls or piers at regular intervals have been correctly interpreted thus by Bulle, *Orchomenos*, p. 73.

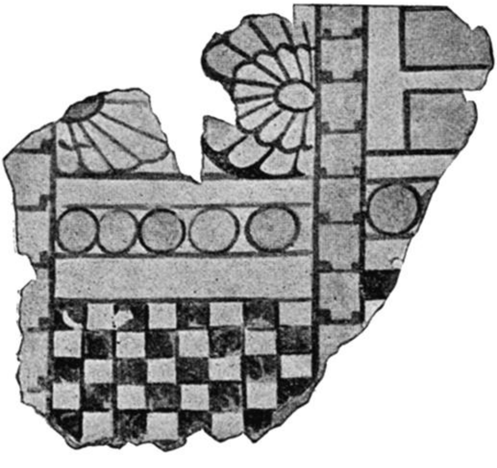
FIGURE 2.—FRAGMENT FROM ORCHOMENOS. (After Dussaud)

A number of other remains which do not show whole buildings, indicate these same architectural features. The clay walls reinforced with imbedded beams are indicated in fresco fragments found at Orchomenos (Fig. 2) and at Tiryns[1]. The columns are shown on a fresco fragment from Cnossus[2], are carved on the Lions' gate at Mycenae, and flank the door to the so-called "Treasury of Atreus" at Mycenae. The lintel with the round ends of the roof beams above it, is shown in fresco fragments from Tiryns, from Orchomenos (Fig. 2) and from Cnossus,[3] on the painted sarcophagus from Hagia Triada, on a gold plaque from Volo, and on a seal impression from Cnossus[1]; it is carved on the façade of a grave at Mycenae, and represented schematically above the column on the Lions' gate at Mycenae and on small terra-cotta columns from Cnossus.[2]

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[1] Bulle, *Orchomenos*, pl. XXVIII, 1. K.D. Arch. Inst. in Athen, *Tiryns*, II, p. 137, fig. 58; pl.. XVI, 5.

[2] *B.S.A.* X, pl. II.

[3] Tiryns, K.D. Arch. Inst. in Athen, *Tiryns*, II, pls. I; XI, 9; XVI, 5. Orchomenos, Bulle, *Orchomenos*, pl. XXVIII, 1 and 4. Cnossus, *B.S.A.* X, p. 42, fig. 14.

Aside from these recurrent architectural features which may be considered typical of monumental palace or temple architecture, a series of terra-cotta plaques found at Cnossus[3] indicates a type of civil or domestic architecture. These plaques represent buildings of two or more stories with doors and windows heavily framed in wood, and with the ends of the beams, usually round, which are used for the floors and roofs and for reinforcing the brick walls, clearly marked. In several cases a small rectangular mass is shown above the roof. This in all probability indicates a covering for the head of a stairway by which the occupants mounted to the flat top of the house, similar to the covered stair-heads so characteristic of eastern domestic roofs at the present day.

One other architectural form is occasionally met with, though regularly found neither in the monumental nor domestic architecture. This is a column which tapers upward instead of downward and is surmounted by a species of cubical cap (Fig. 1).[4] This cap is decorated with a series of round spots following the rectangular outline of its face, and apparently shows a continuation of the shaft through a rectangular sinkage in the centre of this face.[5] A similar form, though here used at the bottom instead of the top of a shaft, is found on a fragment of a steatite vessel from Cnossus (Fig. 7).[6] This peculiar type of column has probably a very special use and will be considered later.

The Minoan architecture as indicated by the artists is, then, extremely simple straightforward construction; and the truthfulness of its representation is testified by the actual remains. These show us uniformly, foundation and basement walls of stone in squared coursed blocks; on these, walls of sun-dried brick reinforced by longitudinal and transverse beams; windows and doors in these walls framed in heavy timbers;[1] and open porticoes flanked by walls and spanned by lintels borne on one or two wooden columns. The wood work and the columns have of course disappeared, but their positions are clearly indicated in the walls and on the floors, and the actual form of the columns (tapering slightly downward) is proven by their impressions in encasing walls, built about them before their destruction.[2] Being of wood the roof constructions have left no remains, but the literalness of the other architectural indications, together with the natural simplicity of such a construction, leaves no doubt that the lintels or great beams, round[3] or square,[4] bore other round beams laid close together, on which a thick flat layer of clay served as protection from the sun and the occasional rains.

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[1] Hagia Triada, *Mon. Ant.* XIX, 1908, pl. II. Volo, 'Εφ. 'Αρχ. 1906, pl. 14. Cnossus, *B.S.A.* XI, p. 12, fig. 5.

[2] Mycenae, Perrot and Chipiez, *Histoire de l'Art*, VI, 627, fig. 275. Cnossus, *B.S.A.* VIII, p. 29, fig. 14.

[3] *B.S.A.* VIII, pp. 16–17, fig. 9b.

[4] Seal impression from Cnossus, *B.S.A.* IX, fig. 35. Steatite rhyton from Hagia Triada, *Rend. Acc. Lincei*, XII, fasc. 70, p. 17.

[5] Miniature fresco from Cnossus, Candia Museum.

[6] *B.S.A.* IX, p. 129, fig. 85.

SURVIVALS OF MINOAN FORMS.—The most striking support to this analysis of Minoan architectural forms is given by a series of examples showing their persistence down to the present day in Asia Minor, where the earlier civilization was never overrun by the Achaeans, as in Greece and Crete. A coin from Cyprus representing the temple of Paphos[5] shows exactly the Minoan portico flanked by smaller porticoes; the tombs of Lycia duplicate in stone the heavy rectangular framework of Minoan doors and windows, and show flat roofs carried on juxtaposed round beams projecting above square lintels, in exactly the Minoan manner (Fig. 3).[6] The Ionian entablature, found as far as Persia to the east and Athens, in the porch of the Caryatids, to the west, which substitutes slightly separated square roof beams for the earlier round ones, and an architrave of superposed beams for the simple lintel, is an obvious derivative. And at the present day the wall of clay reinforced with wood,[7] the wood column on a stone base, and the round roof beams borne on a wooden lintel and bearing a flat clay roof, are of constant occurrence in the Mazenderan.[8]

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[1] *B.S.A.* VIII, p. 64, fig. 31; cf. p. 55, fig. 29.

[2] *B.S.A.* XI, p. 7.

[3] Palace, Cnossus, *B.S.A.* VII, pp. 107, 117, Royal Villa, Cnossus, *B.S.A.* IX, p. 151, pl. I.

[4] Royal Villa, Cnossus, *B.S.A.* IX, p. 151, pl. I.

[5] Perrot and Chipiez, *op. cit.* III, p. 120, fig. 58; p. 266, fig. 199.

[6] Perrot and Chipiez, *op. cit.* V, pp. 363–364, figs. 249, 250. Noack: *Baukunst des Altertums*, pl. 60.

[7] Perrot and Chipiez, *op. cit.* VI, pp. 485–486, fig. 180.

[8] Perrot and Chipiez, *op. cit.* V, p. 498, fig. 319.

Frankness of Minoan Architecture.—Throughout this Minoan architecture it should be especially noted that there is no attempt whatever to disguise the structural members or to simulate them where they do not actually occur. There is even a distinct effort to indicate them where they would naturally be hidden. For instance, it would be quite unreasonable to leave the walls of clay and timber exposed to the weather, and we have definite evidence that they were regularly given a protecting coat of stucco. But the frescoes and the terra-cotta plaques indicate with perfect clearness the timbers in these walls, which must have been covered from the eyes. The obvious explanation is, that having concealed the construction for practical reasons, the Minoan architect revealed it again by painting the timbers on the stucco, so that the Minoan eye would be satisfied by seeing a wall construction which it perfectly understood.[1] Even in the palace interiors large timbers are constantly represented in the frescoes. These were undoubtedly painted directly over real timbers imbedded in the wall, so that the construction should be revealed throughout.[2] This literalness is altogether in keeping with the realism of Minoan decoration.

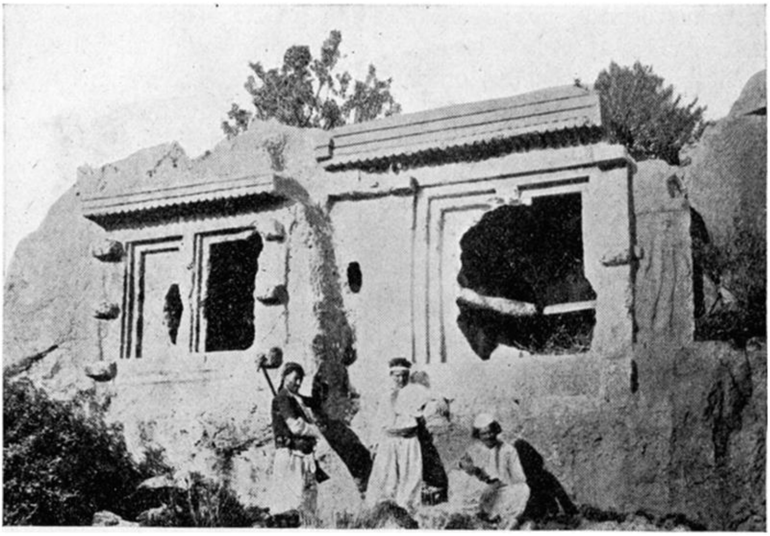

Figure 3.—Lycian Tombs at Port Tristomo

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[1] Bulle, *Orchomenos*, p. 97.

[2] K.D. Arch. Inst. in Athens, *Tiryns*, II, pl. VIII.

A second point to be observed is that the Minoan order has no frieze in the classic sense. The frieze in classic architecture is a horizontal band surmounting the architrave and surmounted by the cornice. It may be considered as marking the space occupied by the roof beams which rest upon the architrave,—the usual interpretation of the Doric frieze,—or as a band introduced between these beams and the architrave, as in the classic Ionic and Corinthian orders where the roof beams, represented by the dentils, form part of the cornice. If we use the word in the first sense, then the Minoan frieze consists invariably of a series of tangent circles, the round ends of the roof beams (Figs. 1 and 2). If in the second sense, then, as is the case with the Asiatic-Ionic and Persian orders, the entablature has no frieze at all.

It seems altogether improbable that so literal constructionalists would have ever disguised their round beam ends behind such a decoration as the alternation of rectangular triglyphs and metopes characteristic of the Doric frieze, or that they would have introduced a purely decorative band between the upper and lower members of their construction, and then,—since the Doric cornice has no dentils,—removed all traces of this upper member.

SUGGESTED RESEMBLANCES TO THE DORIC ENTABLATURE.—In spite of this improbability a number of archaeologists have claimed to find in Minoan forms the prototype of the triglyphs and metopes, and Perrot and Chipiez have developed with great ingenuity and at considerable length a transition from one to the other.[1]

Pernier and Mosso[2] claim that the decorative form of the Doric frieze was derived from certain seats in the vestibule of the southern wing of the palace of Phaestus (Fig. 4). These seats, or rather stone benches, have horizontal tops and vertical faces composed of rectangular slabs of alabaster. In the vertical faces heavy slabs, higher than they are wide, alternate with thinner slabs, longer than they are high, and both vertical and horizontal slabs are decorated with incised lines running in the long direction of the slab. The appearance is certainly suggestive of triglyphs and metopes, especially as the vertical slabs are divided into three parts by two channels heavier than the other incised lines. But to base an architectural derivation on a mere resemblance of form is extremely rash. The alternation of vertical supporting members and long intermediate panels is the most obvious and suitable method of constructing a thin partition of a material like alabaster, which is easily worked into thin slabs; and the incised lines in the direction of greatest length are the most natural form of ornamentation. But it would be neither obvious nor suitable for the late Minoan or semi-barbarous early Greek builders to take a structural motive altogether suitable to bench fronts of alabaster, and reproducing it in wood (a material for which it is totally unsuited, the manufacture of boards being rare and difficult among primitive peoples), to introduce it as a non-structural element above the columns. It is equally improbable that they should have totally reorganized the construction of the entablature to allow it to present the decorative appearance of the front of a bench.

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[1] *Op. cit.*, VI, pp. 710 ff.

[2] Pernier, *Mon. Ant.* XII, 1902, p. 48, fig. 13. Mosso, *Palaces of Crete*, p. 61.

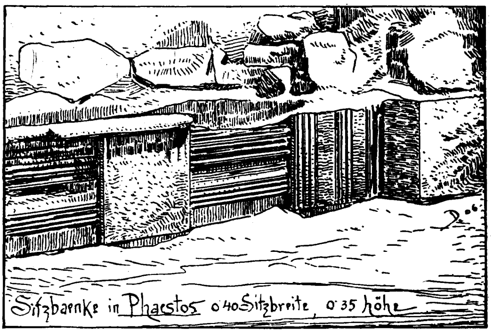
Sitzbaenke in Phaestos 0·40 Sitzbreite, 0·35 höhe

FIGURE 4.—BENCH AT PHAESTUS
(After Durm)

THE HALF-ROSETTE ORNAMENT.—Dörpfeld, Perrot and Chipiez, and Evans[1] find the inspiration for the alternation of triglyphs and metopes in the "half-rosette ornament" first brought to light in the famous "alabaster frieze" found at Tiryns. The "half-rosette ornament" consists of a series of elongated rosettes, each of which is divided in the centre by a wide vertically striped band. This vertical division is held to correspond to a triglyph, the horizontal panel between two vertical divisions, occupied by two half-rosettes, tangent, or nearly tangent to each other, corresponding to a metope. This ornament is used in decoration as a unit composed either of one vertical division with a half-rosette on each side (Fig. 1), or of two vertical divisions with two half-rosettes between them (Fig. 2). It is also found as a running motive of vertical divisions alternating with two half-rosettes.

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[1] Dörpfeld in Schliemann, *Tiryns*, p. 284. Perrot and Chipiez, *loc. cit.* Evans, *J.H.S.* XXI. 1901, p. 195.

Now if this ornament were found to be a free decorative motive without structural significance, which might be painted or carved almost anywhere, like the spiral or wave pattern, it might quite conceivably have been used to decorate a lintel, or as a band around the upper part of a wall, and thence have become a band above the lintel. The question resolves itself into an investigation of the exact character and use of the half-rosette ornament.

The examples of this ornament so far brought to light are:

I. Alabaster "frieze" with blue glass inlays, from Tiryns (Schliemann, *Tiryns*, pl. IV; Durm, *Baukunst der Griechen*,[3] *Handbuch der Architektur* II, 1, pl. II; Perrot and Chipiez, *Histoire de l'art*, VI, p. 549, fig. 230 and pl. XVII, fig. 1).
II. Red breccia "frieze" from Mycenae, Tomb I (Schliemann, *Mycenae*, fig. 151; Perrot and Chipiez, *op. cit.* VI, p. 547, fig. 227 and p. 627, fig. 276).
III. Red breccia "frieze" from Mycenae, Tomb I (Perrot and Chipiez, *op. cit.* VI, p. 628, fig. 277).
IV. Red limestone "frieze" from Cnossus (*B.S.A.* VII, p. 55, fig. 16; Mosso, *Palaces of Crete*, p. 179, fig. 80).
V. Ivory plaque from Mycenae ('Εφ. 'Αρχ. 1888, pl. VIII, fig. 11; Perrot and Chipiez, *op. cit.* VI, p. 547, fig. 226).
VI. Glass ornament from Tomb at Menidi (*Das Kuppelgrab bei Menidi*, pl. III, fig. 24; Perrot and Chipiez, *op. cit.* VI, p. 548, fig. 228).
VII. Gold models of façades from Mycenae (Schliemann, *Mycenae*, fig. 423).
VIII. Fresco from Cnossus (Fig 1) (*J.H.S.* XXI, pl. V, and fig. 66).
IX. Fresco from Orchomenos (Fig. 2) (Bulle, *Orchomenos*, pl. XXVIII, 1).
X. Fresco fragments from Tiryns (K.D. Arch Inst. in Athen, *Tiryns*, II, p. 137, fig. 58).
XI. Fresco fragments from Cnossus (not pictured or well described, *B.S.A.* VII, p. 108; VIII, p. 75; X, p. 41).
XII. Vase from royal Tomb, Isopata (Evans, 'Prehistoric Tombs at Knossos,' *Archaeologia*, LIX, p. 549, fig. 144).

No. I, when discovered, was supposed to be a decorative band which had originally ornamented the upper part of the wall, and had slipped from there to the position it occupied on the ground;

but later investigations point to its having been the front face of a stone bench exactly similar to those found at Phaestus.[1] Even Dörpfeld has changed from the earlier idea and considers that the original position was on the ground where found.[2] The original position and purpose of Nos. II, III, and IV are altogether conjectural, though to judge from their material they probably formed part of some architectural structure or decoration. No. V might have formed part of a box or miniature shrine, and No. VI was probably either an amulet, an inlay in a box or miniature shrine, or an element in a species of flat picture similar to those formed by the terra-cotta house plaques and marine objects found at Cnossus. In No. VII the half-rosette ornament occupies a position above the main central portion of the triple façade and has been variously considered to represent a clear-story with windows or shutters,[3] or an altar placed upon the roof.[4] In Nos. VIII, IX and X the half-rosette ornament invariably represents some architectural feature, it being in juxtaposition with the conventional representation of brick and timber walls. And in No. XII alone can it be definitely said to be used as pure ornament. Even here, as Evans notes,[5] the presence of black and white checkers, which on the frescoes represent stone work and are very uncommon in vase painting, points to its being an architectural motive. The fact that the half-rosette ornament is never found among the variety of decorative bands so freely used in Minoan frescoes indicates strongly that it had a definite significance to the artists of these decorations. A form which represented a particular architectural feature could only be used in its proper place in their pictures of palaces or temples, and, being realists, these artists could no more use it as a motive of free decoration than they would have so used their conventional representations of brick and timber walls or of the round roof beams of the entablature.

Moreover, this half-rosette ornament by itself has apparently no religious significance, as it is never found used talismanically on seals, coffins, etc., as are the double-headed axe and the figure 8 shield. No. VI of the examples cited is the only one which gives the slightest suggestion of having had intrinsic magic virtue,[1] so that the probabilities are that in this case, too, the half-rosettes formed part of some larger composition.

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[1] K.D. Arch. Inst. Athen, *Tiryns*, I, p. 37 and note 2.

[2] Schuchhardt, *Schliemann's Excavations*, p. 117 (English translation).

[3] Schuchhardt, *op. cit.* p. 200.

[4] Evans, *J.H.S.* XXI, 1901, p. 191.

[5] 'Prehistoric Tombs of Knossos,' *Archaeologia*, LIX, p. 550 and note a.

POSITION OF THE HALF-ROSETTE ORNAMENT.—If, then, this motive must be considered not as free decoration or as a religious emblem, but rather as a definite architectural form, it should have a definite position in relation to other architectural forms and a definite underlying structural significance. If this position prove to be at the upper part of a wall, its right to be considered as the prototype of the Doric frieze would seem to be fairly founded. Nos. VII and IX (Fig. 2) do show it to be above some sort of architectural structure, though in No. IX it is difficult to say just what this structure is, on account of the incompleteness of the fragment. On the other hand, No. VIII (Fig. 1) shows it definitely at the foot of the column, and No. I, the only real example found *in situ*, rested upon the ground. The original positions of the other examples are indeterminate, owing to their detached or fragmentary condition.

Close analysis will show that the known positions are not so various as they seem, for while No. IX unquestionably is placed above some sort of a wall, it is important to notice that directly below it is a row of round beam ends between an upper and a lower transverse beam (Fig. 2). This indicates that the half-rosette ornament does not form the upper part of the wall below it, but is placed directly above the ceiling of the story to which that lower wall belongs. Owing to the incompleteness of the fragment it is impossible to say whether its position is on a roof, as in No. VII, or on a main floor, as in No. VIII, with the black and white checkers below belonging to a basement or foundation wall. In either case its position is definitely not that of a frieze, which would of necessity be below the cornice, marked by the round beam ends. Furthermore, the Minoan roofs, flat terraces, were unquestionably much used as uncovered floors, so that there is no intrinsic difference in the position of an object placed upon a floor or upon a roof.

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[1] Evans, 'Prehistoric Tombs of Knossos,' p. 550, considers that the half-rosettes on No. XII are conventionalizations of the sacred double-axe. Such an extreme conventionalization would be very unusual for the realistic Minoans, especially since no intermediate steps have been found. Moreover, Nos. VII, IX, and X show the half-rosettes with their rectangular sides away from each other rather than joined by an intermediate vertical bar, while No. I and even the pattern on No. XII itself terminate in several places with a similar single half-rosette. This would be impossible, if the unit, consisting of two half-rosettes joined by a vertical bar (which would be the integral form, if derived from the double-axe), had any symbolic value. The axelike form in the centre of these rosettes on No. XII must be considered then as simply one of several insignificant variants to be found in the internal decoration of this motive.

Having settled the position of the half-rosette ornament, and knowing from No. I that its structure consisted of thin slabs placed on edge, the only remaining problem is as to its function. No. I has been considered to be the front of a bench, or, by others, to be a decorative dado[1] while in No. VII the ornament is held to mark the front of an altar.

THE HORNS OF CONSECRATION.—Some light may be thrown on the function of this decorated panel work by the relation it bears to another characteristic Minoan object, the so-called "horns of consecration." In Nos. VII and VIII (Fig. 1), the "horns of consecration" are shown directly above the half-rosette panels. In the other fresco fragments the tops of the half-rosette bands are missing, but from the marked uniformity of Minoan representations it seems quite likely that here also they were surmounted by the famous horns.

The exact function of these horns is not definitely known, though it is generally admitted that they were of some religious significance, being regularly shown on representations of altars and in connection with the two-headed axe and other emblems of divinity. The inference from this is that, whenever they are represented in a scene, the scene is a religious one, and any buildings in which they are shown must be shrines. This inference is ably combatted by Bulle,[2] who points out that on account of the omnipresence of this symbol one would be forced to the improbable conclusion that the Minoan artists never represented any architecture that was not religious. The famous miniature fresco from Cnossus (Fig. 1) seems to him much more probably a garden party with a court pavilion in the centre than a sacred ceremonial scene, in spite of an abundance of the "horns of consecration" in and on the pavilion. Certainly it would not be natural in depicting a sacred rite to devote all the attention to the audience and none to the ceremony itself.

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[1] K. D. Arch. Inst. in Athen, *Tiryns*, I, p. 37. Durm, *Jh. Oest. Arch. I.* X, 1907, p. 68. Bulle, *Orchomenos*, p. 84.

[2] *Orchomenos*, pp. 77–78.

His conclusion is that while the horns were actually sacred objects, those shown in connection with architecture were not the objects themselves, but representations of them, painted upon the walls of secular buildings for talismanic purposes, just as the double-axe is frequently found incised on the stones of the palace of Cnossus.[1] This conclusion is open to two objections. In the first place, in the considerable amount of fresco decoration from Minoan palaces which has been found, there are nowhere any "horns of consecration," though to judge from the miniature frescoes they should have been painted everywhere; nor are they anywhere found cut in the stonework. In the second place, the miniature frescoes always show them along the floor line.[2] Now it is inconceivable that a sacred emblem should be painted along the base of a wall, where it could be seen with difficulty and would be particularly exposed to damage. It is evident, then, that these objects were not mere paintings but possessed three dimensions, and were always shown in frescoes upon the floor, or roof, or upon an altar, because they had to rest upon a horizontal surface. If we admit Bulle's reasonable contention that some of the structures depicted must be of a secular character, then we are forced to the conclusion that the "horns of consecration" were objects used sometimes with a religious purpose and sometimes with a secular one, perhaps honorific; in the same way that the figure 8 shield, which is often a religious emblem, must certainly have had an utilitarian function. This double rôle seems probable.

Several actual examples of "horns of consecration" have been found in Crete.[3] These are of stone, stucco, or clay with a stucco coating, varying in size from 20 cm. to 40 cm. across; in three cases at least they were found in shrines (Fig. 5). By comparing the rarity of these objects with the profusion in which they are depicted, it becomes evident that the great majority of "horns of consecration" were made of some perishable material, such as wood, and that those found were copies of the utilitarian article made for sacred purposes in another material and probably of smaller size, like the many votive objects found in Cretan shrines.

HORNS OF CONSECRATION NOT OFFERINGS NOR HOLDERS OF OFFERINGS.—It has been suggested by Evans that these horns were conventional derivations from the actual horns of sacrificial oxen, set before the altar as an offering.[1] The resemblance is obvious, but apart from the fact that such an explanation would be incompatible with any secular use, it absolutely ignores the ardent realism of the Minoan artists. The alternation of bulls' heads and "horns of consecration" on a vase from Old Salamis,[2] instead of supporting Evans' theory, proves the contrary; for why should a reproduction of bulls' horns be represented at the same time as the bulls' horns themselves? Other more reasonable suggestions are, that they were a species of loaf or cake used for offerings, or a basket or bowl to hold offerings. With both these explanations secular use would be perfectly possible, but neither suggestion is supported by the evidence at hand. In the first place in the shrine discovered at Cnossus (Fig. 5), although a vase or dish for offerings stood in front of the altar, the horns were not in or by this vase, but were on the altar itself. Moreover, though various scenes represent votaries before altars, they are never shown holding or offering "horns of consecration," the latter being already upon the altar.[3] In the second place, the horns are never shown containing offerings, but are frequently shown containing the god himself in the aniconic form of a tree (Fig. 6), a cone, a double-headed axe, etc.;[4] and two found on an

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[1] Evans, *J.H.S.* XXI, 1901, p. 110, fig. 5.

[2] *B.S.A.* X. pl. II; *J.H.S.* XXI, pl. V; etc.

[3] Cnossus, *B.S.A.* VIII, pp. 96 ff., fig. 55; IX, p. 12; XI, p. 8. Palaikastro, *B.S.A.* VIII, p. 314, fig. 27. Gournia, Hawes, *Gournia*, pl. XI, 25.

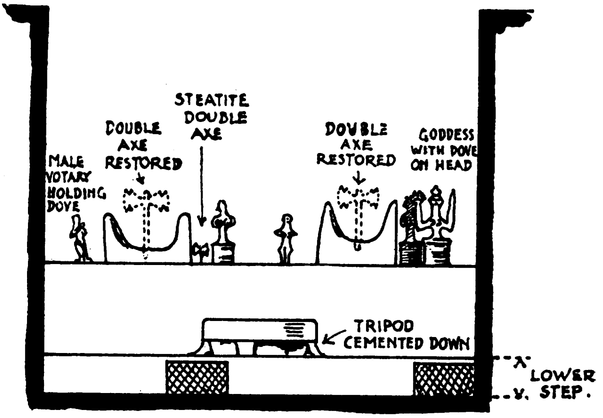

Figure 5.—Shrine at Cnossus. (*B.S.A.* VIII, Fig. 55)

altar of Cnossus have holes in them, evidently for the insertion of the handles of such sacred axes (Fig. 5). Also, the famous sarcophagus from Hagia Triada[1] indicates that regular baskets were used for carrying offerings.

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[1] Evans, *J.H.S.* XXI, 1901, p. 137.

[2] Evans, *op. cit.* p. 107, fig. 3.

[3] *B.S.A.* IX, fig. 85.

[4] Painted larnax, Palaikastro, *B.S.A.* VIII, pl. XVIII; Vase fragment, Cnossus, *B.S.A.* IX, fig. 71; Vase, Old Salamis, Evans, *J.H.S.* XXI, 1901, pp. 99 ff., figs. 1, 3, 20, 21, 25, 31.

The "horns of consecration" were, then, not horns except that in Minoan representation they have a hornlike appearance; were neither offerings nor receptacles for offerings, but rather resting places for the god, being shown sometimes occupied by him under his fetish form, and sometimes awaiting his presence. Also, that which is usually considered an altar in representations is not strictly such, in the sense of being a table for sacrifice or offering, but really the throne of the god.

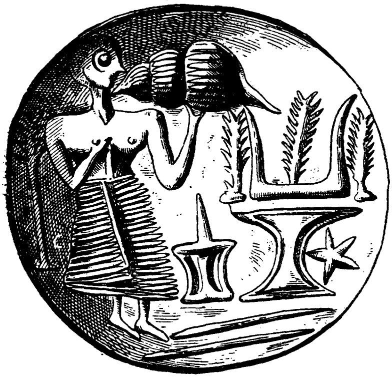

FIGURE 6.—"HORNS OF HONOR" ON ALTAR. (After Dussaud)

HORNS OF CONSECRATION SEATS OF HONOR.—If this be so, this hornlike object when devoted to secular purposes would be a seat, probably movable, probably of wood, and perhaps restricted to the use of the nobility. It must be confessed that the examples found do not suggest great comfort, the largest being less than six inches deep, but it should be borne in mind that these stone and stucco examples are ritual copies of the ordinary object, and just as human figures and animals in similar cases are often little more than flat slabs, so these horns may give the outline in front elevation of an object which in reality had considerable depth. Where a seat two feet wide by two feet deep would be necessary for a human being, one a foot wide by three inches deep would be ample to hold a sacred axe.

As an attempt at reconstruction, I should imagine these seats to be primitively cubical blocks of wood hollowed out to fit the figure, like the stone seats found in the palace at Cnossus.[2] Later they may have been upholstered, as is suggested by an extra line on the inner curves of an example of horns painted on a filler from

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[1] *Mon. Ant.* XIX, 1908, pl. II.

[2] *B.S.A.* VII, pp. 33 ff., fig. 11.

Palaikastro,[1] or may have contained cushions. Even in the crude wooden form, however, they would be considerably more comfortable than a stone bench or floor. Another possibility is that the curve running from horn to horn represents a strip of cloth or leather swung, as in the classic cross-legged chairs, between two supports. In this case there would probably be a front piece of wood of the horn shape and a similar back piece. Between these two would run bars at top and bottom on each side and from top bar to top bar would hang the leather seat.[2]

Square Capped Columns.—Further support is given to the theory that the horns were seats by an analysis of some of the scenes in which they occur. On page 121 mention was made of a peculiar type of column tapering upward with a square cap somewhat resembling a buckle. This shaft and cap is represented on a seal impression from Cnossus with a boxer standing before it; on a steatite rhyton from Hagia Triada, with helmeted boxers fighting in superposed zones; on a fragment of a steatite vase from Cnossus with a procession of youths passing before a stepped wall (Fig. 7);[3] and on the miniature frescoes from Cnossus (Candia Museum) with crowds of gaily dressed women on a terrace or broad flight of steps (Fig. 1). In no case does it occur in connection with any structure resembling a house. In two of the instances the shaft seems to continue above and below the cap, while with the ordinary order, superposed columns are unknown. The connection with the two scenes representing boxers indicates that it was a feature characteristic of the arena. This is borne out by the other two examples; the stepped wall in the one (Fig. 7) strongly suggesting the stepped seats of an amphitheatre, which in the other (Fig. 1) are indicated in front view by long horizontal lines. There can be little doubt, then, that these shafts represent tall poles to support an awning over the spectators, and the buckle-like object is possibly a splice in the shaft, possibly an attachment for a light wooden gallery, but most probably simply the attachment of a horizontal beam to hold the shaft firm at its middle height. On the fragment showing the procession the buckle is evidently the lashing by which the bottom of the shaft is held to the stone work of the wall.

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[1] *B.S.A.* X, p. 214, fig. 5.

[2] A possible confirmation of this construction is given by the famous "throne of Minos" found at Cnossus (*B.S.A.* VI, pp. 37 ff.; Durm, *Baukunst der Griechen*^{3}, p. 55, fig. 33). This stone seat consists of two pieces, a large slab for the back, and in front a cubical block cut in evident imitation of a wooden chair. Between the legs in front appears a curious inverted arch, which can hardly be pure ornament. The top pieces on the two sides, joining the front and rear legs, are cut with a curved under surface unlike the other pieces of the chair frame, which are all rectangular in section. These curves are, almost exactly, continuations of the inverted arch shown in front, and the suggestion is very strong that we have here in stone the imitation of what, in the wooden prototype, was a flexible seat hung from side to side and supporting a large cushion.

[3] Seal impression, *B.S.A.* IX, fig. 35. Rhyton, *Rend. Ac. Lincei,* XII, p. 17. Fragment of vase, *B.S.A.* IX, fig. 85.

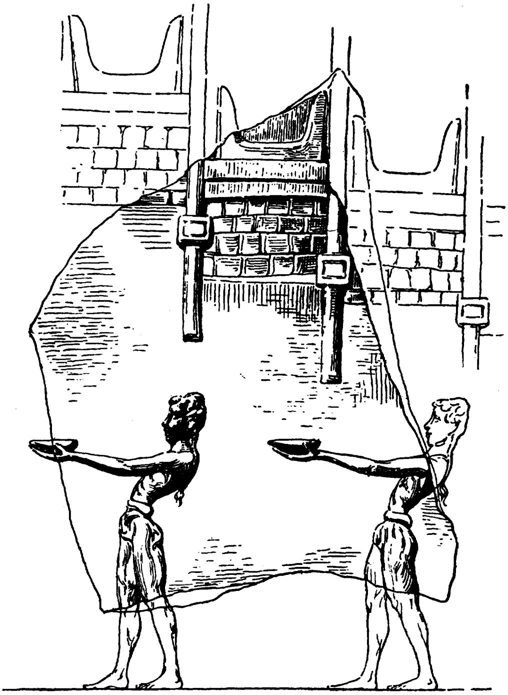

Figure 7.—Steatite Fragment from Cnossus. (*B.S.A.* IX, Fig. 85)

Now on this fragment (Fig. 7) the horns are distinctly shown on the only step of the wall which is complete. The publishers have suggested quite logically that they were on all the steps. But why should a sacred emblem be set on every tier in an amphitheatre, and what more natural than that an object so placed should be a seat? It is true that the horns are turned at right angles to the steps, but the steps are also turned at right angles to the procession. The procession is undoubtedly in the arena, not passing outside it, and the artist has turned his steps sideways because he could indicate their character better that way than by showing them in front elevation. In the same way the horns are shown from the front, because their side view would be a meaningless rectangle. Naturally they would always be shown front face, just as the human head is always shown in profile.

The miniature fresco from Cnossus, as restored by M. Gilliéron (Fig. 1), shows likewise, then, not a religious ceremony, but the gay audience at some theatrical performance. In front, on the lowest tiers, are the townspeople, men and women sketchily indicated in brown and white. Higher up, on a level terrace, are the ladies of the court, gayly dressed and busily chatting. No men appear here. On a second bank of seats, perhaps built of wood above the terrace, are other crowds of indeterminate men and women. In the centre is a pavilion, similar no doubt to one which stood formerly on the great stone bastion in the corner of the "theatral area" at Cnossus, with seats for the nobles of the court inside and on the roof. This whole fresco inside the palace may be a very literal picture of what was often seen on fête days just outside. Of course the pavilion on the bastion *may* have been a shrine, but it is much more probable that it was a royal box for the king and his highest dignitaries. It is also much more probable that the horns on top and within the pavilion were the seats of nobles, than that they were set there to lure innumerable deities.

DIGNITARIES NOT REPRESENTED IN MINOAN ART.—But why is it that the king and nobles are not shown? If the horns are really seats, why are no humans ever shown seated in them? Because royalty is never shown in any way in Minoan art. Egyptian and Assyrian art is full of scenes from the lives of kings and their highest followers, but here such figures are strikingly absent. The only explanation is that, in accordance with not uncommon magical theory, to make an image of a man was to entrap his soul. While images in Egypt assured life after death, in Crete apparently they rendered one liable to supernatural control. And if nobles were the only ones allowed the luxury and honor of these wooden seats, it is natural that no picture of a seat should ever show an occupant. The seat implies the noble, as a similar seat implies a god; for the mortal at least, it was deemed safer to let the indication suffice.

HALF-ROSETTE ORNAMENT UNIFORM IN POSITION.—The half-rosette ornament, then, in Nos. VII and VIII decorates the front of a throne or bench, placed in the latter case under a pavilion, in the former upon the roof, and in all probability built up of alabaster slabs exactly similar to those of the famous "frieze" at Tiryns. We can safely conclude also that the other examples, II–VI, whose original locations are unknown, were actual bench fronts in the case of the larger examples, and miniature ones in connection with miniature palaces or temples in the case of the smaller ones. In every instance, whether the "horns of consecration" be a human or divine adjunct, the half-rosette ornament marks a structure which in function and construction is exactly similar to the benches found at Phaestus (Fig. 4), and in other Minoan palaces,[1] which are evidently incapable, on account of their functions, construction, material, and location, of ever having developed into the Doric frieze.

CONCLUSIONS.—The general conclusions of this investigation so far are:—

1. That the Dorian invasion broke the tradition of Minoan architecture in Greece proper;[2] its characteristic forms developing logically in Cyprus, Asia Minor and Persia,—where the earlier culture was not destroyed by these northern barbarians,—into the Ionic and Persian orders.[3]

2. That even if this invasion did not destroy the traditions of architectural forms, as it certainly did of vase painting and decorative forms, there is nothing to be found in Minoan construction or decoration which could logically have given rise to the distinctive features of the Doric entablature.

3. That as this entablature cannot be considered Minoan in origin, it must have been brought into Greece by the Dorians from the north, or developed out of their particular genius to serve their particular ends after they had settled in the country. From the great antiquity indicated by the fixity of its forms, the former hypothesis seems the more probable.

DORIC FORMS COPIED FROM A PRIMITIVE CONSTRUCTION IN WOOD.—There seems to be no way of knowing what the architecture of the Dorian tribes was like, prior to their descent into Greece.

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[1] Maraghiannis, *Antiquitès Cretoises*, I, pls. V, VII, and VIII.

[2] This refers primarily, of course, to elevational forms of architecture. As the invaders built many structures on the foundations of Mycenaean buildings which they had destroyed, it is quite possible that the plans of the earlier architecture affected the later Greek plans. The use of tie-beams to reinforce walls of unburned brick was also continued after the invasion, but this is a system of construction so natural and general in primitive civilizations that it it quite possible that the Dorians had been long familiar with it themselves.

[3] A comparison of the proto-Ionic stelae from Cyprus in the Metropolitan Museum, New York (di Cesnola, *Cyprus*, p. 117) with the iris forms common in Minoan decoration (Evans, 'Prehistoric Tombs of Knossos,' *Archaeologia*, LIX, pl. CL, fig. 142a) leaves little question as to the origin of the Ionic capital.

But though it is therefore impossible to trace the Doric entablature down from its sources to its historic form, it may be quite possible to conjecture from the latter, what the earlier form must have been. Many attempts in this direction have been made, usually based on the assumption that the stone forms are copied from an earlier construction in wood. In favor of this assumption can be advanced the strong superficial resemblance to wooden forms, and the fact that in early stone examples the form and construction are quite contradictory; while the arguments opposed are chiefly, that it would be counter to Greek spirit to imitate a wooden form in stone, and that the wooden forms which have been suggested all present many illogicalities. But there are also very strong arguments in favor of the theory of wood construction from external evidence. These are: first, in historic times the Greeks made extensive use of wood and unburned brick, and such constructions would naturally antedate the use of stone. Second, Pausanias (V, 16, 1) mentions having seen a wooden column in the temple of Hera at Olympia, a building whose walls were undoubtedly made of unburned brick; this wooden column naturally implies a wooden rather than a stone entablature. Third, Euripides (Bacchae 1214) speaks of fastening a head by pegs to the triglyphs of a temple; this indicates that these members at least were of wood. Fourth, Vitruvius (IV, 2, 2) specifically states that the Doric entablature reproduces wooden forms.

In matters of Greek architecture Vitruvius' statements must be taken with some caution, for it is doubtful whether he ever had been to Greece, and the Romanized types with which he was familiar and whose proportions he details, differed considerably from the originals. But Vitruvius was well read in Greek architectural writings, which from his account must have been quite numerous, and his statements are probably based on these authorities. So, while in detail he is often inaccurate, his broad statement that the Doric frieze is derived from wooden forms has much weight, being undoubtedly inspired by similar statements on the part of Greek writers.

SUGGESTED RESTORATIONS OF PRIMITIVE WOODEN FORMS.—Not content with the simple fact of a wooden derivation Vitruvius goes on to explain in detail what the primitive wooden form was, and here his testimony is very questionable. It should be borne in mind that he had never seen the primitive wooden frieze of the Greeks; and being well acquainted with the wooden entablature of Etruscan architecture, he probably fitted the unknown Greek forms to the known Etruscan mould. At any rate it is evident from the argumentative tone he uses that he did not follow his Greek authorities literally.[1] According to him the triglyphs represent the ends of ceiling joists or tie beams, which have been trimmed off and decorated with painted boards cut in triglyph form, the mutules representing the ends of the principal rafters.

On the face of it this derivation seems simple and probable enough and has been generally followed by writers on the forms of classic architecture, such as Reynaud, Hittorff, and others, but investigation reveals several difficulties. Why should the regulae and taenia be interposed between a girder and the joists resting upon it? How account for the invariable six guttae below the regulae or the equally invariable three divisions on the triglyph? Is the band running across the top of the triglyph and the similar one across the top of the metope simply decorative? If so, why is that on the metope almost invariably slightly smaller than that on the triglyph, instead of being of the same size? If the mutules are rafter ends, why should their under surfaces always be studded with eighteen pegs? And why should the joists be of so very much greater size than the rafters?

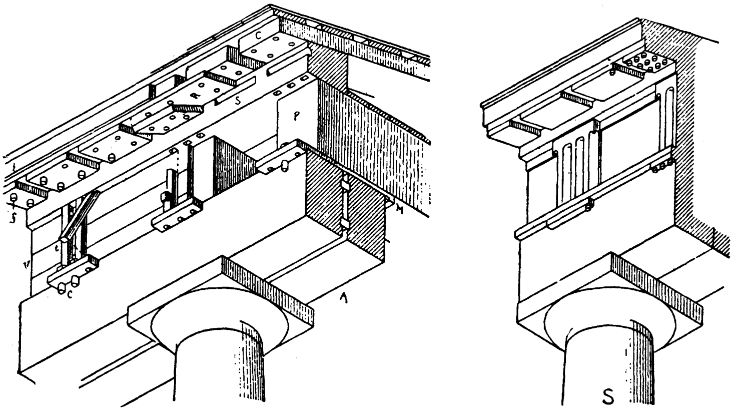

FIGURE 8.—ORIGIN OF THE DORIC ENTABLATURE: CHOISY

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[1] Vitruvius, IV, 2, 4.

Choisy[1] has attempted to solve several of these difficulties by assuming that the original rough construction of joists and rafters was covered by a revetment of small pieces of wood held on by pegs (Fig. 8). His solution, as always, is extremely ingenious, but seems far too complicated for a primitive people, and fails to explain many of the characteristic features of the frieze; *e.g.* the taenia, the cap band on triglyphs and metopes, etc. The discrepancy in the comparative size of the joists and rafters he explains on the assumption that the joists supported the rafters in mid span by posts and purlins, a construction made necessary by "la grande profondeur des portiques des temples primitifs."[2] But a construction in which there is one cross beam supporting the purlin for every two rafters is so extravagant as to be altogether improbable.[3] Lastly, there is the difficulty raised by Viollet-le-duc[4] that if the triglyphs represent beam ends, the ceiling within the portico should be on a level with the bottom of the triglyphs instead of being invariably on a level with the top.

This difficulty Choisy does not consider at all, but Guadet[5] is "very much shocked" by it. "Why should one represent," he says, "the ends of beams, which do not exist, at a level lower than that of the ceiling? If the construction of the wooden entablature had comprised beams at the level later occupied by the triglyphs, we may be sure that the construction of the stone entablature would have preserved its beams at this same level, for nothing could have been easier. On the other hand, the stone ceilings set above the triglyphs must be the faithful reproduction of an earlier arrangement which also placed its wooden ceilings at this same higher level." But though this convinces him that the triglyphs cannot represent beam ends, it does not prove to him at all, as it does to Viollet-le-duc, that the primitive entablature was not of wood, and studying the question "en Architecte," he arrives at a new hypothesis.

In the first place, on the evidence of Euripides[6] he assumes that the primitive wooden frieze crowned the wall of the cella rather than of a surrounding portico, for the suggestion that one might climb through the space between the triglyphs would be senseless unless this opening gave into the interior of the temple proper. From this he argues that the metopes were simply a series of windows around the top of the cella wall and the triglyphs short upright posts set between them (Fig. 9). Strong support is given to this assumption by Vitruvius' argument that the *triglyphs*

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[1] *Histoire de l'Architecture,* I, pp. 287 ff.

[2] *Op. cit.* I, p. 280.

[3] Choisy's restoration of the Arsenal of Piraeus (*Études epigraphiques sur l'Architecture Grecque,* pl. II) shows five rafters for every cross beam.

[4] *Entretiens sur l'Architecture,* I, p. 50.

[5] *Elements et Theorie de L'Architecture,* I, pp. 342 ff.

[6] *Iphigenia in Tauris,* 113 ff.

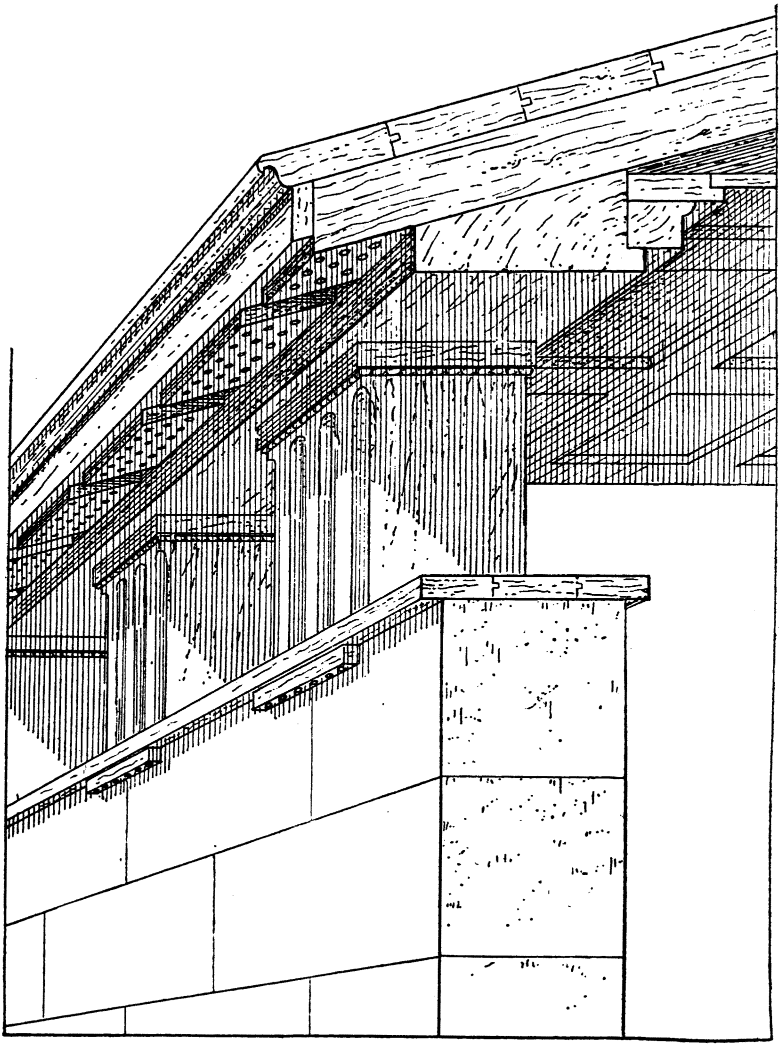

FIGURE 9.—ORIGIN OF THE DORIC ENTABLATURE: GUADET

cannot have been, "as some say," windows.[1] It is probable that some Greek writer on architecture did state that the triglyphs were originally windows, meaning that the *band of triglyphs*, or frieze, was a band of windows. Vitruvius, reading him literally, found the statement incredible. So far as it goes, Guadet's hypothesis is extremely logical and clears up many of the difficulties in the other explanation. The position of the ceiling above the triglyph is explained, there is no longer the discrepancy in size between joists and rafters, the band across the top of the triglyph becomes a simple cap for this short post, and by considering the architrave as the top of a wall (obviously of unburned brick instead of stone as Guadet has it)[2] rather than as a wooden beam, the taenia becomes naturally a wooden plate to hold the superstructure, with the regulae, transverse pieces set into the wall to hold the taenia in place. The much greater projection of the cornice in the Doric than in the other orders may also be advanced in support of this theory, for such wide eaves are meaningless unless they shelter some sort of opening directly beneath.

There still remain, however, a number of points which Guadet's theory does not explain. That the wooden regulae should be pegged to the wooden taenia is natural, but the invariable six pegs, close together, would certainly tend to split the latter, and without some other justification would be much poorer construction than, say, three or four pegs only. It is natural enough that the triglyphs should be decorated on their faces, and also natural enough that this decoration should assume the form of vertical lines, as in the alabaster slabs of the benches at Phaestus, but the fixity of this decoration in form and number of parts points strongly to some origin more definite than pure ornament. The question of the band or cap along the top of the metopes is not considered by Guadet, who shows the metope spaces open. It is not unnatural that, when these spaces came to be filled with terra-cotta or stone slabs, the cap of the triglyphs should be carried as a decorative band across these slabs, but it is quite unnatural that it should be almost invariably at a slightly higher level. Moreover, Guadet's construction of the rafters and eaves is altogether unsatisfactory. He shows the mutules as the lower faces of large beams which have a thickness equal to the height of the corona, decorated with eighteen absolutely meaningless peg holes; and he does not explain why the space between these rafter ends does not run up all the way to the sheathing boards laid above them, instead of being closed by a soffit which allows only the very bottom of the rafters to be seen. Lastly, the actual construction, which he shows, is almost as impossible in the scale of its pieces as the ceiling joist construction of the earlier hypothesis.

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[1] IV, 2, 4.

[2] Cf. Dörpfeld, 'Der antike Ziegelbau und sein Einfluss auf den dorischen Stil,' *Hist. u. phil. Aufsätze E. Curtius . . . gewidmet.*

SCALE OF PRIMITIVE WOODEN FORMS.—To investigate this question of scale the following table of the actual dimensions of the parts of Doric entablatures has been prepared (Table I). The accuracy of these figures cannot be guaranteed to the centimeter, both because of slight variations in the original dimensions and because time has made measurements more or less conjectural in many cases. In the dimensions of width of triglyphs, metopes, and spacings of columns, averages have of course been taken, these always varying considerably in any building. It will be seen at once that there is a close similarity between the proportions of the same parts in the different temples, but to find out accurately what these proportions are it is necessary to divide the parts of each temple by some constant denominator. A brief inspection shows that the heights of the regulae, taenia, triglyph cap, space between triglyph cap and mutule, and the thickness of the mutule are all nearly the same in any given example, while the height of the triglyph minus its cap is approximately ten times the height of any one of these parts. The sum of all these heights, that is, the total height from the bottom of the regula to the top of the mutule, has therefore in each case been divided by fifteen,[1] so as to provide us with a unit of height to which these parts may easily be compared.[2] This unit (Table II, first column) is largest in the early Sicilian examples, ranging from 13 to 15 cm.; one temple, the Olympieum at Girgenti, seems to have a unit of just double size, and one, that of Aphaia at Aegina, a unit of half size. After the middle of the fifth century the unit steadily decreases in size till by the middle of the fourth century it has shrunk to 5 cm. It will be noticed, however, that the Sicilian examples are still generally somewhat larger than their Grecian contemporaries, and that one, the temple "G" at Selinunte, is built at double the scale prevailing at its period.

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[1] In those cases where dimensions are missing, the total has been divided by an appropriate number, less than 15. These totals are numbered with a * in Table I, and these units are followed by a ? in Table II.

[2] In the Hecatompedon at Athens the heights of regula, triglyph cap, metope cap, and space between trigylph cap and mutule are twice the height of the taenia; in this case the sum has, therefore, been divided by 18.

In the "height" columns of Table II are given the results of dividing the actual sizes of the particular parts by the unit of height for each temple; the italic figures give in centimeters the amount by which the actual size exceeds or falls short of the quotient given. Considering the necessarily approximate character of these calculations, these italic numbers may be safely regarded only as showing plus or minus tendencies. It will be seen at once that these proportions are remarkably constant throughout the series, though in several cases there is a slight developmental change in the course of the two centuries considered. Thus, for the first of these centuries the height of the regula is almost exactly 1, in the course of the second it diminishes to a little less than 1. These changes can be tabulated as follows:

Height of regula 1, changing to 1−.
Height of taenia 1, no change.
Height of triglyph 9½−, changing to 10.
Height of triglyph cap, 1¼, changing to 1¾.
Height of metope cap 1¼, no change.
Height of space between triglyph cap and mutules 1, changing to 1½.
Height of mutule 1, changing to ½−.

The same system has been applied to the horizontal dimensions, the width of the epistyle being added to the distance of the columns from centre to centre (twice the sum of the widths of triglyph and metope) and divided by forty. This gives a unit of width (Table II, last column) which very closely approximates our unit of height, though in most cases it is slightly larger. The proportions and developments are approximately:

Width of triglyph 7, changing to 5½.
Width of metope 8, changing to 8½.
Distance of columns on centres 30, changing to 28.
Width of architrave 10, changing to 11½.

Considering the remarkable fixity of these proportions during these two centuries of intense architectural progress, it is per-

TABLE I.

Date	Temple	Authority	Height of Regula	Height of Taenia	Height of Triglyph	Height of Triglyph cap	Height of Metope cap	Space between Tr. cap and Mutule	Height of Mutule	*Total* from bottom of Reg. to top of Mutule	Width of Triglyph	Width of Metope	Distance of Columns on Center	Width of Architrave	Space of Columns + width of Architrave
Early VI c.	Corinth, Apollo	*A.J.A.* IX., 1905, p. 44 seq.	.115	.113							c. .78	1.17	c. 3.60	1.65	*5.25*
Early VI c.	Athens, Hecatompedon	Wiegand, *Die Porosarchitektur*	.200	.136	1.13	.240	.220	.235	.150	2.091	c. .785	c. 1.085	c. 3.74	1.05	*4.79*
c. 581	Selinunte, "C'	Koldewey and Puchstein	.130	.170	1.30	.160	.160	.127	.165	2.042	c. .92	c. 1.04	c. 3.84	1.28	*5.12*
c. 570	Selinunte, "D"	K. and P.	.101	.105	1.30	.188	.180	.100	.115	2.089	1.05	1.20	c. 4.50	1.12	*5.62*
c. 554	Selinunte, "F" or "S"	K. and P.	.115	.085	1.30	.190	.165	.185	.095	1.970	1.03	1.26	c. 4.58	1.33	*5.91*
c. 550	Athens, "Pisistratus"	Wiegand *Die Porosarchitektur*	.133	.128	1.152	.186	.167	.180	.093	1.872	c. .785	c. 1.18	3.92		
c. 510	Girgenti, Heracles	K. and P.	c. .170	c. .160		c. .220	c. .220	c. .130	.100	*.780	c. 1.07	c. 1.23	c. 4.61	1.67	*6.28*
500–470	Aegina, Aphaia	Furtwängler, *Aegina*	.052	.052	.710	.11	.085	.050	.06	1.0343	.510	.80	2.60	1.16	*3.76*
—480	Selinunte, "A"	K. and P.				.125	.115	.105	.070	*.300	.639	.845	2.96	1.125	*4.085*
—480	Selinunte, "E" or "R"	K. and P.	c. .130	.180	1.50	.220	.220	.180	.100	2.310	.950	1.41	c. 4.70	1.85	*6.55*
c. 488–472	Girgenti, Olympieum	K. and P.	.265	.275	2.64	c. .470	.465	.310	.17	4.090	1.79	2.28	c. 8.20		
c. 488–472	Girgenti, Hera	K. and P.	.100	.080	1.06	.100	.100			*1.340	.615	.92	c. 3.08	1.295	*4.375*
—450	Olympia, Zeus	Curtius and Adler	.150	.150	1.525	.215	.180	.150	.130	2.320	1.06	1.540	5.22	1.125	*6.345*
447–438	Athens, Parthenon	Stuart and Revett	.078	.111	1.15	.156	.15	.172	.085	1.752	.928	1.284	4.22	1.764	*5.984*
c. 440	Paestum, Poseidon	K. and P.	c. .06?	.17	1.26?	.18?	.22?	.16?	.08?	1.91	c. .90	c. 1.30	c. 4.38	1.43	*5.81*
	Selinunte, "G" or "T"	K. and P.	.200	.290	2.02	.290	.275	.230	.240	3.270	1.34	1.96	c. 6.60	2.27	*8.87*
437–432	Athens, Propylaea	S. and R.	.064	.087	1.006	.120	.070			*1.347	.70	1.106	3.42	1.345	*4.765*
430	Bassae, Apollo	Blouet, *le Morée*	.036	.085	.715	.130	.10	.056	.046	1.068	.532	.810	c. 2.71	1.007	*3.717*
430–420	Segesta	K. and P.	.135	.162	1.428	.193	.174	c. .160	.109	2.187	.850	1.32	c. 4.35	1.74	*6.09*
430–420	Girgenti, Concord	K. and P.	.0990	.121	1.145	.150	.150	.160	.057	1.732	.640	.960	c. 3.20	1.28	*4.48*
421	Athens, "Theseum"	S. and R.	.0683	.075	.698	.115	.088	.095	.0589	1.1100	.507	.761	2.59	.9729	*3.5629*
	Rhamnus, Nemesis	*Uned. Ant. Attica*	.055	.057	.496	.070	.057	.066	.038	.782	.373	.516	1.872	.9729	*2.8449*
c. 390	Nemea, Zeus	Blouet	.059	.094	.993	.147	.110	.150	.056	1.499	.733	1.137	c. 3.74		
c. 390	Olympia, Metroon	Curtius and Adler	.041	.059	c. .510	c. .090	c. .071	c. .077	c. .025	.802	.405	.585	2.01	.510	*2.520*
c. 350	Epidaurus, Asclepieum	Cavvadias, *Epidaure*	c. .040	c. .073	.487	.105	.090	c. .080	c. .040	.825	.440	.688	c. 2.27		

TABLE II.

Date	Temple	Unit of Height	Height of Regula	Height of Taenia	Height of Triglyph	Height of Triglyph cap	Height of Metope cap	Space between Triglyph cap and Mutule	Height of Mutule	Width of Triglyph	Width of Metope	Distance of Columns on Centers	Width of Architrave	Unit of Width
Early VI c.	Corinth, Apollo	.12?								6	9 −*.01*	27½	12½+*.01*	.131
Early VII c.	Athens, Hecatompedon	.12−	1⅔	1 +*.01*	9½	2	2 −*.02*	2	1 +*.03*	6½	9	31	9 −*.03*	.12
c. 581	Selinunte, "C"	.14−	1 −*.01*	1 +*.03*	9½ −*.03*	1 +*.02*	1 +*.02*	1 −*.01*	1 +*.02*	7 +*.02*	8 +*.02*	30	10	.128
c. 570	Selinunte, "D"	.14	¾ +*.01*	1 −*.03*	9½ −*.03*	1¼+*.01*	1 +*.04*	1 −*.04*	1 −*.02*	7½−*.01*	8½+*.01*	32 +*.02*	8	.14
c. 554	Selinunte, "F" or "S"	.13	1 −*.02*	½ +*.01*	10	1½−*.02*	1½−*.03*	1½−*.02*	¾	7	8½	31 −*.01*	9	.148
c. 550	Athens, "Pisistratus	.13−	1	1	10 −*.02*	1⅓+*.01*	1¼	1⅓	¾	6	9 +*.01*	30		.13?
c. 510	Girgenti, Heracles	.15+?	1 +*.02*	1 +*.01*		1½	1½	1 −*.02*	¾ −*.01*	7 −*.03*	8 −*.02*	29½−*.02*	10½+*.03*	.157
500–470	Aegina, Aphaia	.07	1 −*.02*	1 −*.02*	10 +*.01*	1½	1 +*.02*	¾	1 −*.01*	5½	8½	28 −*.03*	12½	.094
—480	Selinunte, "A"	.10?				1¼	1 +*.02*	1	¾	6¼	8¼	29	11	.102
—480	Selinunte, "E" or "R"	.15+	1 −*.02*	1 +*.03*	10	1½	1½	1 +*.03*	¾	6 −*.01*	8½+*.01*	29 −*.06*	11 +*.05*	.164
c. 488–472	Girgenti, Olympieum	.27+	1 −*.01*	1	9¾ +*.01*	1¾	1¾−*.01*	1¼−*.03*	¾ −*.03*	6¼+*.03*	8 +*.04*	29 −*.02*		.28?
c. 488–472	Girgenti, Hera	.10+?	1	1 −*.02*	10½+*.01*	1	1			6 −*.04*	8½	28¼	12 −*.01*	.109
—450	Olympia, Zeus	.15+	1	1	10 +*.02*	1½−*.01*	1 +*.03*	1	1 −*.02*	6½+*.03*	10−*.05*	33 −*.02*	7 +*.01*	.159
447–438	Athens, Parthenon	.12−	¾	1 −*.01*	9½ +*.01*	1¼+*.01*	1¼	1½−*.01*	¾	6 +*.03*	8½	28 +*.02*	12 −*.04*	.15
c. 440	Paestum, Poseidon	.13−	½	1¼+*.01*	9¾	1½−*.01*	1¾+*.01*	1 +*.03*	¾ −*.01*	6 +*.03*	9	30 +*.03*	10 −*.02*	.145
	Selinunte, "G" or "T"	.22−	1 +*.02*	1½−*.04*	9¼ −*.04*	1½−*.04*	1¼	1 +*.01*	1 +*.02*	6 +*.01*	9 −*.02*	29¾	10¼	.222
437–432	Athens, Propylaea	.10+?	¾ −*.01*	1 −*.02*	10	1 +*.02*	¾			6 −*.01*	9 +*.03*	29 −*.03*	11 +*.04*	.119
430	Bassae, Apollo	.07	½	1 +*.01*	10 +*.01*	2 −*.01*	1½−*.01*	1 −*.01*	¾	5½+*.02*	8½+*.02*	29 +*.01*	11 −*.01*	.0929
430–420	Segesta	.14+	1 −*.01*	1 +*.02*	10 +*.02*	1¼−*.02*	1¼	1 +*.02*	¾	5¾−*.01*	8¾−*.01*	28¾−*.01*	11½−*.01*	.152
430–420	Girgenti, Concord	.11+	1 −*.01*	1 +*.01*	10½−*.01*	1¼−*.01*	1¼−*.01*	1½	½	5¾	8½+*.01*	28½+*.01*	11½	.112
421	Athens, "Theseum"	.07+	1 −*.01*	1	10 −*.01*	1½	1 +*.01*	1¼	¾	5¾	8½	29 +*.01*	11 −*.01*	.089
	Rhamnus, Nemesis	.05	1	1	10 −*.01*	1½	1	1¼	¾	5¼	7¼	26¼+*.01*	13¾	.071
c. 390	Nemea, Zeus	.10	½ +*.01*	1 −*.01*	10 −*.01*	1½	1 +*.01*	1½	½					
c. 390	Olympia, Metroon	.05+	1 −*.01*	1	10 +*.01*	1¾	1½	1½	½	6¼+*.01*	9¼	32−*.01*	8	.063
c. 350	Epidaurus, Asclepieum	.05+	1 −*.01*	1½	9¾	2	2 −*.01*	1½	¾					

fectly safe to assume that the changes during the preceding, more conservative centuries were even less, and therefore, given enough data to determine the unit of any earlier temple, the actual sizes of the various parts can undoubtedly be guessed to within a few centimeters. Thus the Olympieum at Syracuse has columns spaced on centres about 3.70 m. apart, giving a unit of width of about 0.12 – m.; the temple of Apollo at Ortygia has a column space of about 3.30 m., giving a width unit of 0.11 m.; and the temple of Hera at Olympia also an average column space of 3.30 m., giving a width unit of 0.11 m. This unit is substantiated in the last example by the diameters of the neckings of the capitals, which, though varying markedly, could not have carried an architrave less than one meter wide and more probably carried one of 1.10 m. Now this temple of Hera at Olympia is known to have been built of unburned brick with a wooden entablature, so here we can definitely find the size of the parts of one of these primitive wood constructions. The unit of width 0.11 m. gives triglyphs 0.77 m. wide. The unit of height could not well be less than 0.10 m. and this gives as the height of the triglyphs something between 0.90 and 1.00 m.

Obviously these triglyphs could not possibly have been beam ends, for beams 0.77×0.90 m. set 1.50 m. on centres are preposterous.[1] Also, it is evident that Guadet's restoration is impossible as it stands, for his triglyphs would be posts 0.77 m. square in horizontal section; the mutules, rafters 0.77 m. wide set .75 m. on centres; and the lintel above the triglyphs, and the regulae, timbers also .77 m. wide; all of which would have had to be sawn or hewn out of trees nearly a meter in diameter.

COMPOSITE MEMBERS.—The question at once arises whether these members instead of being single huge timbers might not have been composed of a number of smaller pieces, in the same way that the Persian architrave was composed of superposed beams. The minute that the Doric entablature is regarded in this light all its difficulties disappear, and the restoration of its primitive form becomes simple.

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[1] The rafters in the temple of Poseidon at Paestum measured 0.22 m. square and the great ridge beams and purlins 0.72 – 0.61 m. The largest beams in the arsenal at the Piraeus were 0.75 m. square. The socket of a beam in the Royal Villa at Cnossus measures 0.60×0.80 m. (*B.S.A.* IX, p. 151) but this, like those in the Piraeus, was a girder beam, the common joists were round and only 0.44 m. in diameter.

It should be borne in mind to begin with that, until the invention of the circular saw, planks were a luxury. Primitively wood is rough hewn to approximately square timbers, and is split and dressed with an adze to form planks only where absolutely necessary. Even during the Middle Ages wooden wainscoting was only for the richest; not because of the scarcity of wood, but because of the difficulty of working it into thin sheets. Mediaeval floor joists and the timbers of the elaborate mediaeval roof trusses are always nearly square in section, though of very varying sizes. It can be seen, then, that though the early Greeks and the Cretans before them possessed saws, there was small likelihood that logs 0.80 m. in diameter would be worked into boards 0.10 m. thick, if any other method of construction were possible. A rational form of construction for a primitive people could include only timbers in their natural round form or roughly squared, and, wherever possible, of moderate cross section. This principle is perfectly adhered to by Minoan construction, and we may be sure the early Greeks did not depart from it.

BRICK.—The other element that enters into this primitive Doric construction is unburned brick. Vitruvius (II, 3, 3) states that the Greeks used bricks four palms square for domestic work and five palms square for public work, and with these, half bricks, *i.e.* four by two palms, or five by two and one-half in area. He does not state the thickness of these bricks, but this has generally been assumed to be one palm. A palm in Athens according to the Solonian foot of 0.296 m. would be 0. 074 m.; according to the earlier Aeginetan or Pheidonian foot of 0.328 m. it would be 0.082 m.;[1] what it was in other states and colonies is not definitely known, but the standards certainly varied through a range of several centimeters. As a matter of fact the examples of brick so far found usually indicate a larger standard. Those from the fortifications of Eleusis measure on the average 0.10×0.45×0.45 m., and there is mention of one at the same place measuring 0.492 m.[2] Minoan bricks found at Gournia measure 0.08×0.24×0.35 m. and 0.09×0.37×0.48 m.,[3] some at Cnossus measure 0.12×0.45 m.,[4] and those at Troy are in general 0.10

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[1] Dörpfeld, *Ath. Mitt.* VII, 1882, pp. 277 ff.; XV, 1890, pp. 167 ff.

[2] Caskey, *A.J.A.* XIV, 1910, p. 303.

[3] Durm, *Baukunst der Griechen*^{3}, p. 37, fig. 19.

[4] *B.S.A.* XI, p. 5.

to 0.15 m. thick and up to 0.65 m. wide.[1] Very late Greek examples from the Exedra of Herodes Atticus at Olympia measure 0.05 to 0.065 m. by 0.12 to 0.165 m. by 0.26 to 0.39 m.[2] These last are evidently what Vitruvius calls half-bricks. The thickness of the bricks then (and probably the local palm which served as its standard) varied from 0.15 m. in pre-Hellenic examples to 0.05 m. in Hellenistic times. The superficial dimensions seem to be usually a little greater than an even multiple of the thickness. This is altogether natural, for in general practice the surface dimensions of bricks are multiples of the thickness and the width of a joint combined. The joints in Troy ranged from .01–.03 m. and were probably somewhat smaller in later Greece. Thus the width of the bricks at Eleusis should naturally be 4× (0.10+.01 m.) or 0.44 m., which is approximately their real size.[3]

It will be noticed that the dimensions of the unit in Table II fall within the range of these brick sizes. This is not pure chance, but rather confirms the correctness of the analysis so far, for if the regulae were wooden members set crosswise into the top of a brick wall, they would naturally be of the same thickness as one course of bricks, or a little less to allow for roughness in their execution. It is also natural that the width of the architrave should be an even multiple of whole and half bricks, and these in turn two or four times a unit of width slightly greater than the height of a brick. The half-bricks are evidently necessary to prevent the joints of one brick course coming directly over those of the row below, being placed in alternate courses on the inside and outside of the wall.[4] The wall would be either one and a half, two and a half, or three and a half bricks thick. Two and a half is the most reasonable size for buildings as large as the temples, and two and a half bricks give exactly the ten units of width characteristic of early architraves.

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[1] Durm, *Zum Kampf um Troja*, Berlin 1890.

[2] Curtius und Adler, *Olympia*, Text, II, p. 135.

[3] Too few examples of bricks have been found to state definitely that all bricks were four times as wide as high, but awkwardness of shape makes improbable bricks five times as wide as high, which have been assumed from Vitruvius' statement. Vitruvius does not state proportions but only actual dimensions, and the bricks which he gives as five palms wide were probably not, as has been assumed, one palm, but one and a quarter palms high. Thus the bricks from Eleusis would be a little over five Aeginetan palms wide, but still only four times as wide as high. Such measurements for monumental bricks may be survivals of a still earlier, larger unit. It is not impossible that the palm in Sicily varied from 0.14 m. in early times to 0.10 m. in the fifth century, and in Greece from 0.12 m. in the sixth century to 0.05 m. in the fourth century.

[4] Vitruvius, II, 3, 4.

Assuming a unit height of 0.10 m. and a width of 0.40m. for a brick, and bearing in mind the principles that the timbers should be nearly square and that brick should be used wherever possible, the entablature builds itself up as follows (PLATE VII).

RECONSTRUCTION.—First, a brick wall two and a half bricks (10 units) thick is built. In the top course cross pieces one brick high are laid. These cross pieces total a little less than 7 units in width and being made of square timbers evidently consist of six pieces 0.10×0.10 m. laid side by side, the irregularities of the hewing and the five joints taking up the extra 0.10 m. Between every two sets of cross pieces two bricks are laid, making the interval 0.8 units wide. On these are laid longitudinal timbers to protect the top corners of the wall. These may extend all the way through the thickness of the wall or may be only along the inner and outer face. If these timbers are one unit square and four be laid along each edge, a single brick will fill the space between, if three be laid along each edge a brick and a half brick will fill the space, and with two timbers two bricks could be used. The last is the most economical arrangement. Now short piers are to be erected above the transverse members, leaving openings two bricks wide between them. The appearance of the triglyph at once suggests a pier composed of nine vertical shafts each two units thick, which, in order to waste the least possible wood, are trimmed as octagons instead of squares. A brick pier would be more economical than this wooden pier but for reasons to be considered later would present too friable a face. As a compromise, however, three of these octagonal timbers may be placed in front and backed with a brick pier, one and a half bricks wide; such an arrangement would account for Vitruvius' statement (IV, 2, 2) that the *faces* of the triglyphs were separate pieces of wood painted with blue wax. This brick pier did not run through the thickness of the wall, since no trace of it is shown on the inside of the stone friezes. The latter evidently represent a form in which the openings have been blocked up, showing decorated panels on the outside (the metopes), and on the inside a continuous brick wall carried past triglyphs and metopes. If the brick pier behind the three triglyph timbers were one and a half bricks deep, the inner wall of the frieze could only have been one-half brick, while if the pier were one brick deep, the wall could also be one brick thick (PLATE VII, 3). Moreover, a brick pier one and one-half bricks square would require quarter-bricks for the corners, therefore one and a half by one seems the most probable size for these piers.

Through each of the six transverse timbers below, a peg is driven up into the three octagonal posts. This makes two pegs to each of the posts, sufficient to anchor them securely at the bottom, at the same time holding the longitudinal timbers in place. If the three posts instead of being backed by a brick pier were backed by other posts, it is difficult to see how these other posts could be secured at the bottom. It would be possible to face the brick piers with posts on the inner as well as on the outer side, but apart from the fact that no triglyphs show on the inside of stone entablatures, there are no guttae, representing pegs, to be seen on this face. In many cases the inner edge of the wall on which the piers stand is finished with a moulding instead of a square taenia. This evidently indicates a terra-cotta cap as shown in PLATE VII, 3.

From post to post a lintel is placed consisting of five timbers, each one unit square. To fasten these in place by pegging them to the triglyph post would weaken them unduly, moreover the inner ones could not be pegged to the brick piers, therefore they are mortised into six other timbers of slightly greater depth (to allow for cutting away the mortise), which run transversely across the top of each pier, forming the triglyph caps. This accounts for the difference in depth between the triglyph and metope caps shown in the stone friezes. It is quite possible that pegs were driven down through these cap pieces into the three octagonal posts, but these pegs would of course be hidden by the lintel beams.

In pre-Hellenic and Lycian roof construction, the roof and ceiling would be one and the same, and would consist of round or square beams laid horizontally close together, and covered with a thick layer of clay. The beam ends of this roof would show from the front as a band of roundels or dentils. In some Italo-Doric examples which show Asiatic influence,[1] there is such a band of dentils exactly in this place. The roof construction of the Dorians, however, is radically different; it is not level but has a slight slope, and as far back as we have any evidence, is always covered with baked tiles. These differences evidently point to a climate where rain was more frequent than in Crete and where possibly snow was not unknown. Since the climate of Greece did not change to any great degree between the time of the Mycenaean and early Greek civilizations, it seems probable that the Dorians brought their roof construction with them from the north, tiles and all. The Doric temples known to us seem regularly to have had a horizontal ceiling below the sloping roof. It is hard to say why this should be, except for purely decorative reasons. This ceiling, as is evident from the later stone examples, was not built simply of beams laid side by side, but was coffered. The space to be covered was spanned by beams at regular intervals, on which other pieces of wood were laid at right angles, and so on until the interspaces became progressively small enough to be closed with single flat clay or terra-cotta slabs. There can be little doubt that the roof itself was constructed in the same general manner as this ceiling, except that it must have had, above the coffers, a layer of clay and rushes to provide an even bed for the roof tiles. In case there were no separate horizontal ceiling, the roof beams would rest directly on the lintel above the triglyph piers, but where the ceiling existed its beams would rest upon the lintel first, occupying a height of one unit, and above these would come the roof beams. A ceiling beam would come over each pier, with possibly another one between each pair. These intermediate beams, however, seem improbable, judging from later stone ceilings. Moreover, the ceiling being so much lighter than the roof they are not here necessary.

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[1] For example, the Corintho-Doric temple at Paestum, Koldewey and Puchstein, *op. cit.* I, pl. 31. Cf. Kas'r Fir'aun, Petra, Brünnow and von Domaszewski, *Provinz Arabia*, I, fig. 200, and the Theatre of Marcellus at Rome.

To make an even bed for the roof beams a course of brick is laid on the lintel, filling out the spaces between the ceiling beams and serving to distribute the weight of the roof over all the five members of the lintel.

On this, timbers one unit square are laid parallel to the slope of the roof. These are grouped together to form flat beams. Over each vertical pier is a group of six occupying the full width of the pier. Between the piers is another group which is made of such width that the spaces between the groups of rafters can be easily spanned by a regulation brick four units wide. The intermediate group in earlier examples consisted apparently of three or four timbers, in later examples it was regularly made of six timbers.[1] It is possible that a wooden sill mortised to hold the beams was placed on the bricks above the lintel, or actually replaced these bricks. It seems more in accord with the general principles of this primitive architecture to assume that the roof beams were laid in a deep bed of clay mortar directly upon the bricks, the spaces between the beams being filled either with brick or with short pieces of wood in front to hold the mortar behind. The slope of the roof is so slight that such a construction would give a very excellent bearing all across the lintel. The beams project beyond the face of the lintel, in some cases a distance of three units, in others six units[2] to form a broad eave to shelter the openings in the wall below.

There is no indication in the stone Doric architecture as to what the original construction of the roof above this point was, nor does it vitally concern our restoration. However, it seems to me probable that the earliest form consisted simply of bricks laid upon the groups of rafters, to span the spaces between them, and on these a sort of lath work, to carry the "wattle and daub" in which the roof tiles were laid (PLATE VII, 1). To anchor this construction and prevent the bricks from sliding off, transverse timbers were apparently laid upon the ends of the rafters and secured to them by pegs driven from below (the guttae in the mutules). In the early examples with an eave projection of three units there would be three such transverse timbers and in the later examples, with a projection of six units, six timbers; in this case, however, only every other one would be pegged, to avoid unduly weakening the rafters. Above these transverse timbers another larger one laid along the outer edge of the roof and held on by the same pegs driven through the rafters from below, would serve as a "ground" for the clay tile-bed and give a solid edge to the roof. Flat painted terra-cotta plates fastened to this timber covered the exposed edge of the roof, forming at the same time a highly decorative band. From below, this roof construction would show long shallow panels running from eave to ridge, similar to those in the roofs of many Etruscan tombs.

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[1] Temple C at Selinunte with three beams to the intermediate rafters gives an interspace of 2 units; temple D, also with three beams, an interspace of 2½ units. The Hecatompedon at Athens, with four beams, gives an interspace of 2¼ units, and the average, where six beams are used, is 1½ units.

[2] This distance is not necessarily fixed; Temple F at Selinunte indicates a projection of four units with four transverse timbers above.

The great disadvantage of this construction would be that the weight would be borne very unequally by the rafter timbers, some of the bricks resting on but two timbers while others rest on four. The obvious remedy is to interpose transverse timbers between the bricks and rafters, to distribute the weight. Small blocks three units long set in between would serve to hold them in place (PLATE VII, 3–4). The general similarity to the construction clearly shown in the stone coffered ceilings emphasizes the probability of such an arrangement. The roof tiles which protect the whole, are flat with cover tiles over the joints, in no essential different from those of historic times.

FORMS WHICH ARE CHARACTERISTIC OF MATERIALS.—The structure thus built up is a thoroughly practicable piece of building, employing no piece of wood over two units (c. 0.20 m.) square, is quite in accord with Greek wood and brick technique so far as it is known, and agrees in every detail with the Doric entablature as translated into stone. Certain variations in these stone entablatures only tend to prove the correctness of this theoretical wooden form, being quite in keeping with its structure. Such, for example, are the variations in the details of the Hecatompedon at Athens, the regulae and lintels above the triglyphs being two units square each, for greater strength, two rows of bricks being placed above the lintel, and the transverse beams above the rafters being also two units square as shown by the presence of two instead of three rows of guttae under the mutules; the change from three rows of guttae to four in the mutules of temple F at Selinunte; and the corner triglyph on the pronaos of temple E, which shows three upright posts on one side and four on the other.[1] Such changes indicate a conscious copying of a perfectly comprehended construction.[2] On the other hand, Roman examples of Doric entablatures indicate a blind tradition, for in them occur such anomalies as corners occupied by metopes rather than by triglyphs, and mutules which have retreated into the soffit of the cornice, leaving only the guttae as decoration. It seems therefore altogether probable that the Greek architects

[1] Koldewey and Puchstein, *op. cit.* I, figs. 96 and 177.

[2] I am quite unable to account for the regulae with five guttae published by Wiegand, *Porosarchitektur der Akropolis zu Athen.* At Locri Epizephyrii mutules with five guttae have been found (*Not. Scav.*, 1911, Sppl., pp. 27 ff., fig. 26), but this is a very corrupt colonial example, and shows moreover five bars to the triglyphs. The combination of five guttae in the regulae with three barred triglyphs seems to me so freakish as to be almost incredible.

had actual examples of the wooden prototype under their eyes until quite a late period, in spite of the fact that no definite mention of such examples has come down to us. It seems also probable that the much discussed "module" of Doric architecture was not derived from the diameter of the column but from the size of the brick,—a much more rational proceeding.

Another interesting point is that whereas the taenia, regulae, and all the parts presumably copied from wood on brick show plane surfaces, the moulding at the top of the corona has a curvilinear profile which is altogether suitable to terra-cotta. This same difference is to be seen on the inner side of the entablature; here the taenia is often rectangular, but also often moulded, and the surface of the frieze, where a filling has covered triglyphs and metopes, is crowned with a beak moulding similar to that outside, evidently also indicating a revetment of terra-cotta. The top of the classic anta indicates a similar terra-cotta revetment fastened around the primitive wooden posts, the face of the revetment projecting beyond the face of the post. The Romans, it will be noticed, ignored these niceties derived from the difference in the original material of mouldings.

One last question, which in reality is the fundamental question of all, remains to be answered. Why should a primitive people ever evolve such an elaborate structure as this protodoric entablature seems to have been? The derivation from a row of windows can hardly be considered adequate, in spite of the presumed authority whom Vitruvius combats. For while the metopes would certainly make excellent windows, there could be no necessity for such a continuous row in so sunny a country as Greece; and isolated windows, rectangular holes in a brick wall, could have been built with no more complicated woodwork than a simple lintel across the top.

Fortunately there exists a written account of a secular structure which, though nowhere called a Doric frieze, bears such striking resemblance to this hypothetical brick and wood entablature that there can be little doubt as to the practical identity of the two. This is the contract drawn up for the restoration of the walls of Athens in 306 B.C.[1] These walls, repaired in the fourth century, were evidently of earlier date, being probably built about 479 B.C.[1] The restoration merely copied the earlier form of construction. Unfortunately for us, this rendered unnecessary to the contractor the description of many details. Though the inscription is much mutilated in parts, the section relating to the gallery along the walls is in a good state of preservation and includes the following directions:[2] "Wherever there is an injury measuring more than six dactyls he shall lay new bricks, leaving openings two bricks in width, making the height of the parapet three feet, that of the openings ten courses of bricks; and he shall lay wooden lintels extending through the width of the wall, fastening them with dowels, the lintels to be one course of brick in thickness and eight feet long, and he shall place below the lintels blocks and he shall lay six courses of brick. . . . And where there is no roof, he shall roof the gallery with rafters and planks,[3] placing them crosswise, or else he shall mortise square timbers setting them three palms apart, *ἐκ τοῦ ἐπάνωθεν*.[4] And having built up with brick upon the wall, he shall trim the front ends of the rafters so as to be vertical, making them project not less than one foot and a half from the wall, and he shall nail on a beam as a crowning member of the cornice, making it straight on top, its width to be seven dactyls, its thickness one palm; and he shall cut a rabbet in its inner face of the thickness of a sheathing plank, and its front he shall make according to the line. And within he shall nail on with iron nails sheathing planks three palms apart, one dactyl thick, five dactyls wide. And after laying upon the sheathing moistened rushes and under these beanstalks or rushes, he shall cover the whole with a layer of clay mixed with straw three dactyls in thickness. And he shall lay Laconian tiles over the whole gallery of the circuit wall, and shall put in place the tiles (*ἡγεμόνες*) of the long walls wherever they are not in place, laying them all in clay with their faces vertical, and he shall lay the cover tiles all in clay. And he shall cover the front of the roof timbers with Corinthian cornices, trimming the joints so that they shall fit tightly, making them true vertically and horizontally. And having set up a scaffolding he shall put on a coating of clay mixed with straw to the height of four courses. . . . "

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[1] The best transcription of this inscription is in *I.G.* II, 167. The most important discussions in regard to the restoration of the gallery are by K. O. Müller, *de Munimentis Athenarum*, Göttingen, 1836, Choisy, *Études épigraphiques sur l'architecture grecque*, pp. 43 ff., L. D. Caskey, *A.J.A.* XIV, 1910, pp. 298 ff.

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[1] Thucydides, I, 89 ff.

[2] Except for the omission of passages not relating to the part under consideration, Caskey's translation is followed exactly.

[3] *'Επιβλῆσιν* does not mean specifically planks or thin boards, but simply timbers.

[4] "Working from above." The probable meaning is that these transverse timbers were held apart by spacing blocks placed on top of the lower set of timbers.

It will be noticed that some of the dimensions are given in feet and others in sizes of brick. Evidently the bricks were not, as Müller, Choisy, and Caskey have all assumed, one foot square and one palm high, but were probably larger, possibly 0.45×0.45 ×0.10 m. as in the fortifications of Eleusis. The lintels, spanning two openings, are given as eight feet long and the openings as two bricks wide. The piers, then, between the openings must have been less than two bricks wide. The dimensions agree exactly with those of the triglyphs and metopes worked out hypothetically from the measurements of the temples;—piers one and one half bricks wide and ten bricks high with spaces two bricks wide between. On these is a lintel one brick high set upon and pegged into blocks (the triglyph caps). Above this lintel, according to the previous readings of the text, are six courses of brick. This arrangement seems highly improbable as it would serve no useful purpose and would rather seriously load the none too sturdy lintel. It seems more logical for the phrase relating to the six courses of brick to begin the following sentence referring to the piers along the inside of the wall[1], instead of ending the one referring to the lintels. In this case, the roof would rest directly upon the lintels, the position it would also occupy in the hypothetical Doric entablature in cases where there was no horizontal ceiling inside. The roof is of exactly the type of construction that stone reproductions have shown to be the original Doric form; flat beams laid cross-wise forming coffers[2]; a layer of bricks to close the coffers; then furring, reeds, and clay under the roof tiles. The beanstalks or rushes, which are laid under the furring strips (or sheathing planks), are simply to fill in the empty spaces necessarily found on the upper side of a coffered ceiling. Today cinder filling is used in much the same way to serve as a light weight, space-occupying foundation for cement floors. It will be noticed that iron nails are particularly specified for nailing on the furring strips; this may be because these strips were nailed directly to the bricks, where pegs would be useless. In any case, the inference is that nails not so specified are not of iron. The crowning beam is therefore "nailed" on with wooden pegs driven from below, corresponding to the guttae in the Doric mutules. The projection of the eaves (a foot and a half) corresponds absolutely with the later Doric entablatures.[1]

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[1] This sentence has been omitted from the translation as having no immediate bearing on the frieze.

[2] The optional form of construction allowed the contractor is evidently a later manner of building. In the original walls the timbers were apparently laid on top of one another, in 306 B.C. mitering short timbers between those of the first set was apparently the common practice. Such construction would account for the mutules in later examples showing only one-half unit of thickness.

It is true that no mention is made of triglyphs, taenia, and regulae, though it is quite possible that these details were covered in the badly mutilated section of the inscription which immediately follows,[2] but it is certain that piers of unbaked brick, less than 0.70 m. wide, would quickly succumb to rocks hurled from without, unless protected by a heavy facing of wood. The three vertical posts of the triglyphs would furnish an almost ideal protection, identical in principle with the wooden antae which protect exposed wall ends in Minoan and Greek architecture, and the wooden facings used on brick walls by the Egyptians and Assyrians.[3] There is no attempt here to prove an absolute identity between the walls of Athens and the Doric entablature; the evidence is much too fragmentary. The only claim is that the legible section of the building inscription includes many details that are identical with those of the wood and clay Doric forms as reconstructed from the stone replicas, and none that are contradictory, and hence it seems highly probable that the gallery of the walls of Athens presented almost exactly the same appearance as the rows of brick and timber framed openings which crowned the earliest Greek temples. The corollary inference is that these openings in the temples were not windows simply, but loop holes or *crenelations* for defence.

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[1] At the end of the passage quoted there is reference to a frieze of clay plaster, four courses in height. Choisy considers that this was put on the outside and covered four of the six courses of brick which he assumes to be above the lintel. But why should only four of these courses be covered, and why specify that a scaffold be erected for such a simple bit of work? Caskey makes no attempt to clear up the difficulty. It seems to me that this band of clay can be considered as placed in antithesis to the band of Corinthian terra-cotta which in the preceding phrase is specified to cover the roof timbers on the *outside*. In this case it would probably be a vertical surface of clay supported by lathes (scaffolding) to fill the space, on the inner side, between the lintel and the under side of the roof beams. With the normal slope of Greek roofs, this space would be approximately four courses high. It would certainly have to be covered with something. In more monumental work a terra-cotta revetment would probably be used, as indicated in stone examples (Plate VII, 2); in this instance terra-cotta is reserved for the more exposed exterior.

[2] Dr. L. D. Caskey has pointed out to me that the terms *θεάνοι* and *ἔνδεσμοι*, which occur in another badly mutilated section of the inscription, refer to long longitudinal beams and transverse beams to hold them in place. These may, of course, have been used only in the main body of the wall, but as the edge of the parapet would stand in greater need of such reinforcement than any other portion, Dr. Caskey suggests that we have here a reference to the *taenia* and *regulae*.

[3] Choisy *Hist. de l'Arch.* I, p. 25, fig. 10; p. 103, fig. 2. The faces of fortified towers at Nineveh are ornamented with a treatment evidently derived from a wood revetment,—square beams at the corners, perhaps of cedar, with a facing

It is natural that the Dorians, who were essentially a military people, should have developed first a type of military architecture. It is also natural that the *megaron* of the king, the "keep" of the citadel, should be well crenelated around the summit of its walls. And when the *megaron* had ceased to be a fort and, becoming a temple, had changed, with its function, from brick and timber to stone, what more natural than that it should have preserved the image of its early type,[1] while the real fortifications, continuing not only the form but the function of the Doric entablature, served to check any departures from the old structural arrangements?

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of round beams, perhaps of palm, between. The substitution of burned brick for the earlier unburned brick made this revetment unnecessary, but its form was preserved. See V. Place, *Nineve et l'Assyrie*, II, p. 50; III, pls. 21, 26, 33.

[1] English churches in the Middle Ages were similarly crowned with wholly useless battlements.

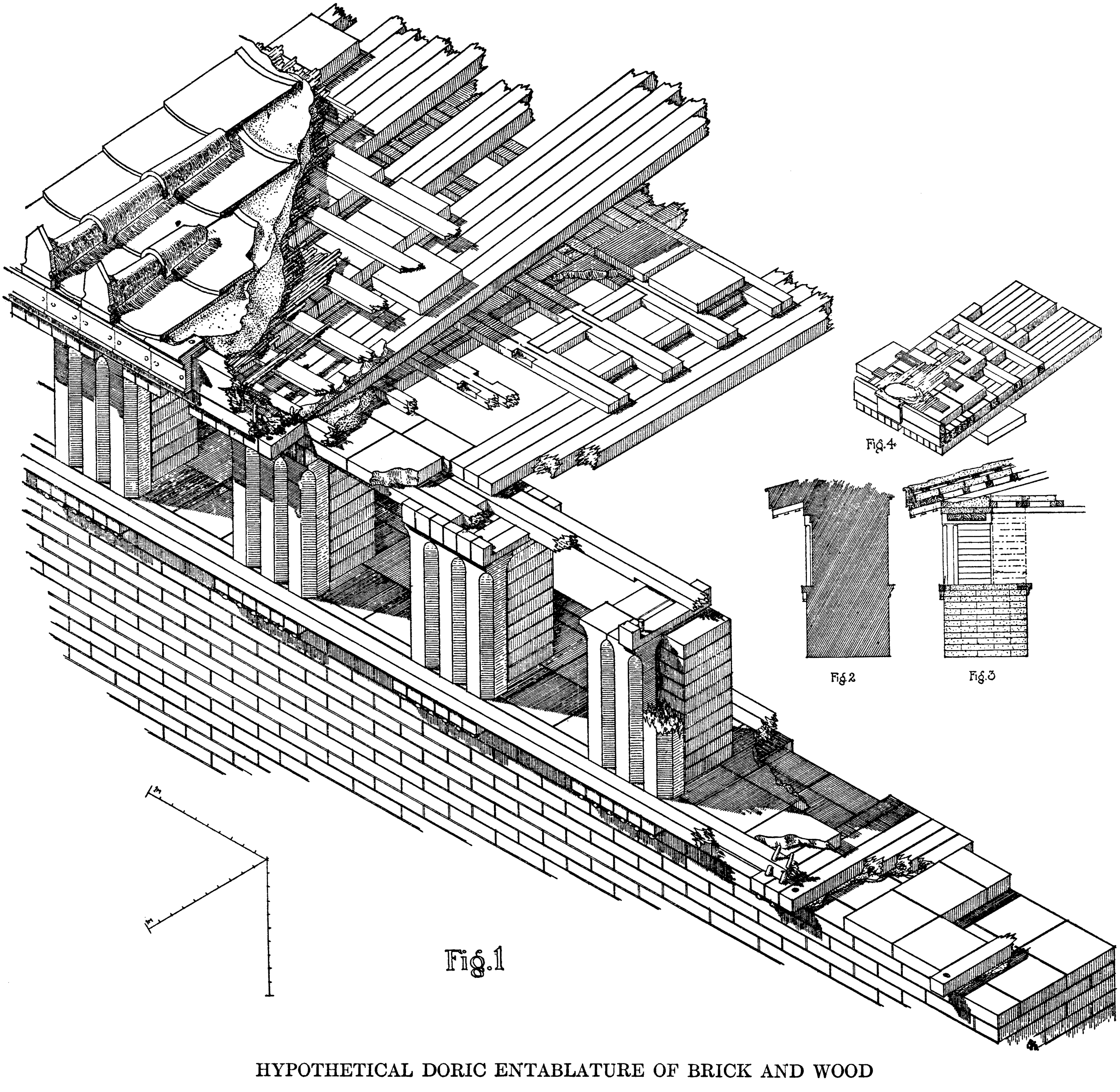

Fig.4

Fig.2

Fig.3

Fig.1

HYPOTHETICAL DORIC ENTABLATURE OF BRICK AND WOOD